TOPO

OPERATION MANUAL

AMW Machine Control, Inc.

WELCOME TO TOPO

Topo easily and rapidly captures the data points that define a field's surface. These points can be loaded into other programs to generate contour lines, compute volumes, design landforms and water management systems, and much more.

Whether using the touchscreen interface or utilizing a standard keyboard, **Topo** can be navigated easily during a site survey. The software can be adapted to nearly any vehicle or even used by a surveyor on foot.

Topo can be set to work in international and U.S. Survey feet or meters. A typical user in the USA will choose U.S. Survey feet. All numbers will be calculated and displayed in tenths of feet, so that 6.5' is the same as 6'6".

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DEFINITION OF TERMS

Capture	Collecting data points.
Control Point	A point of known elevation, usually tied to world coordinates. A benchmark.
Device	Interface device that automatically controls the blade, such as a control module.
Instrument	Positional equipment, typically GPS.
Local Point	NEZ coordinate system that uses 'fake' coordinates, meaning they are not consistent with State Plane or UTM.
Machine Control	Automatic control of the blade.
NEZ	Coordinate system of feet and meters, rather than latitude, longitude and altitude. Northing (N) Easting (E) Elevation (Z).
Plot	Graphic display window on the Working Screen.
State Plane	NEZ coordinate system with zones designed for each state.
Survey File (.svy)	File that contains all the data points captured, and other relevant information.
Rod	Distance from the GPS antenna reading point to the blade or ground.
UTM	NEZ coordinate system with zones designed on longitudinal lines.

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FILE TYPES

Most files used by **Topo** will be stored in the directory named C:\AMW\DATA.

Control Points File

The Control Points File (.CTL) is used while setting up an instrument. The .CTL extension automatically attaches to the job name. It can also be copied from another file. This file uses the NEZ description (Northing-Easting-Elevation.) Points from this file will be displayed on your plot window as small triangles. The control point stored in the .CTL file are known world coordinates, sometimes called benchmarks. They allow the data sets to match up to those collected and used earlier in a job.

Survey File

A Survey File (.SVY) contains the points captured when collecting topographic data on a surface. This file starts out empty when you create a new job, and the .SVY file extension automatically attaches to the job name. Points from this file will be displayed on your plot window as dots. This file is usually used to generate an NEZ (Northing-Easting-Elevation) file and/or a Drawing Exchange File (.DXF) to import into other programs.

Drawing File

A Drawing File (.DRW) defines the background image to be displayed on the plot window, along with the other data. A .DRW file is generally built from a .DXF file.

Ground Surface File

A surface file (.FBG) built from a design file. This file can be created from many other file types. An .FBG file is almost always used for pre-designed jobs.

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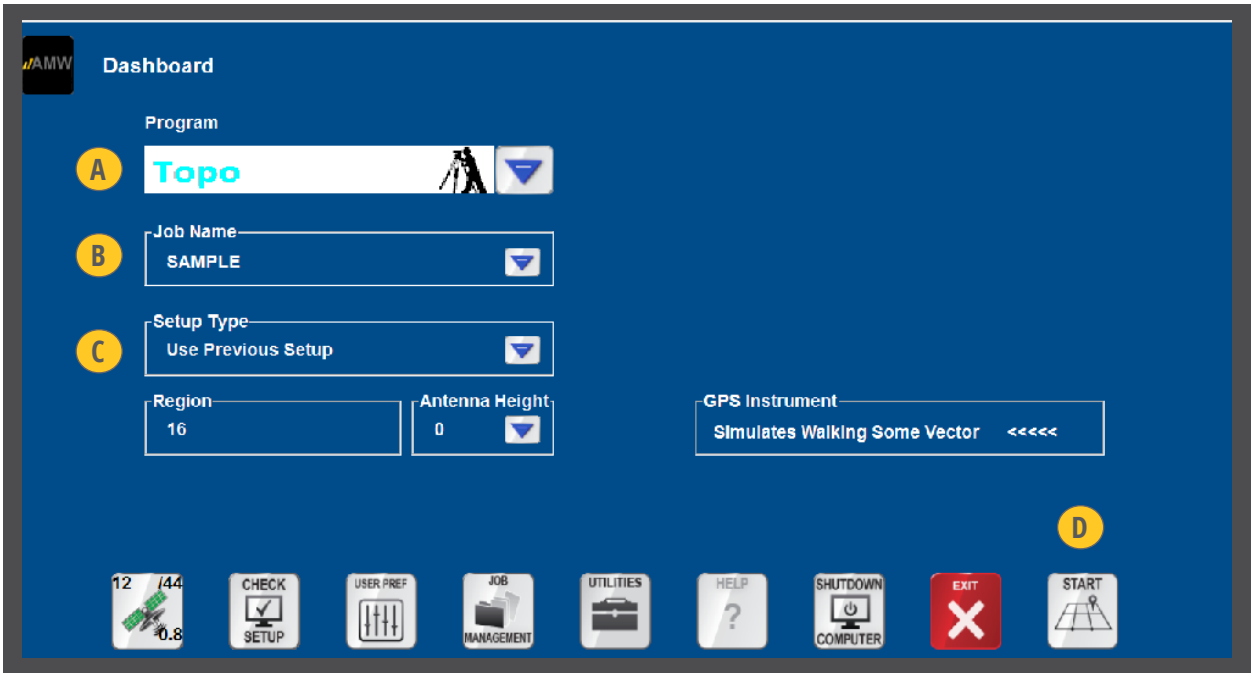
JOB SETUP

See Dashboard Operation Manual for more detail.



A. Select **Topo**.

B. Select an existing job or set up a new job.

C. Verify the setup type, region, antenna or rod height, GPS instrument, and GPS quality.

D. Press *Start* to open the Working Screen.

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JOB SETUP

When setting up a new job, there are several coordinate system options. Typically, a new job will use a 0 Point option as there will not be pre-existing control points.

Use Previous Setup

Use this option when returning to a prior job and using a “smart” base station or the Continuously Operating Reference Stations (CORS) Network.

UTM Coordinates, 0 Point

Create a job with no preset control points. **Topo** will determine the correct zone using the worldwide coordinate system, or it can be selected from a list.

UTM Coordinates, 1 Point

Select to enter a job with an existing UTM control point. **Topo** will determine the correct zone using the worldwide coordinate system, or it can be selected from a list.

2 Local Point Setup

Select to enter a job with two or more existing control points. The job orientation is based on two control points, without relying on a coordinate system.

State Plane, 0 Point

Use this option when entering a job with no preset control points in the United States. Select the appropriate State Plane zone from the 124 geographic areas across the country.

State Plane, 1 Point

If you have preset control points, choose this option to work within the State Plane Coordinate system. Select the appropriate zone for your location, select the correct control points and read the instrument

TM Grid, 0 Point

Use this option in Australia when entering a job with no preset control points.

TM Grid, 1 Point

Use this option in Australia when entering a job with a control point.

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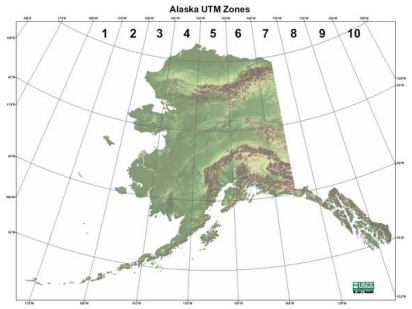
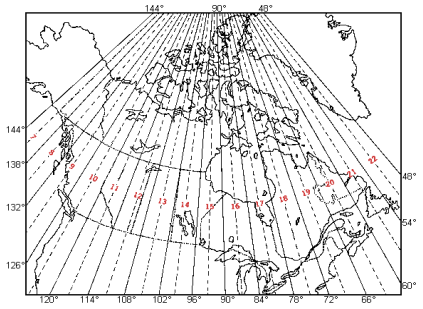
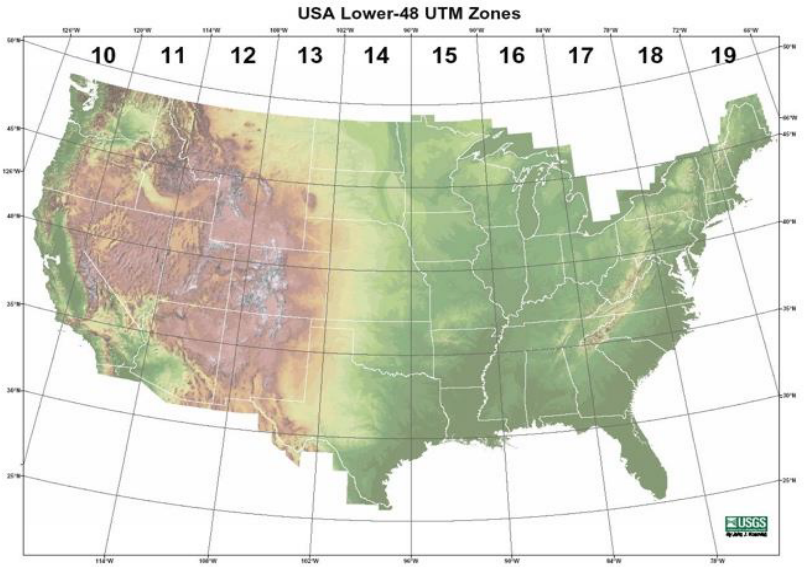
JOB SETUP

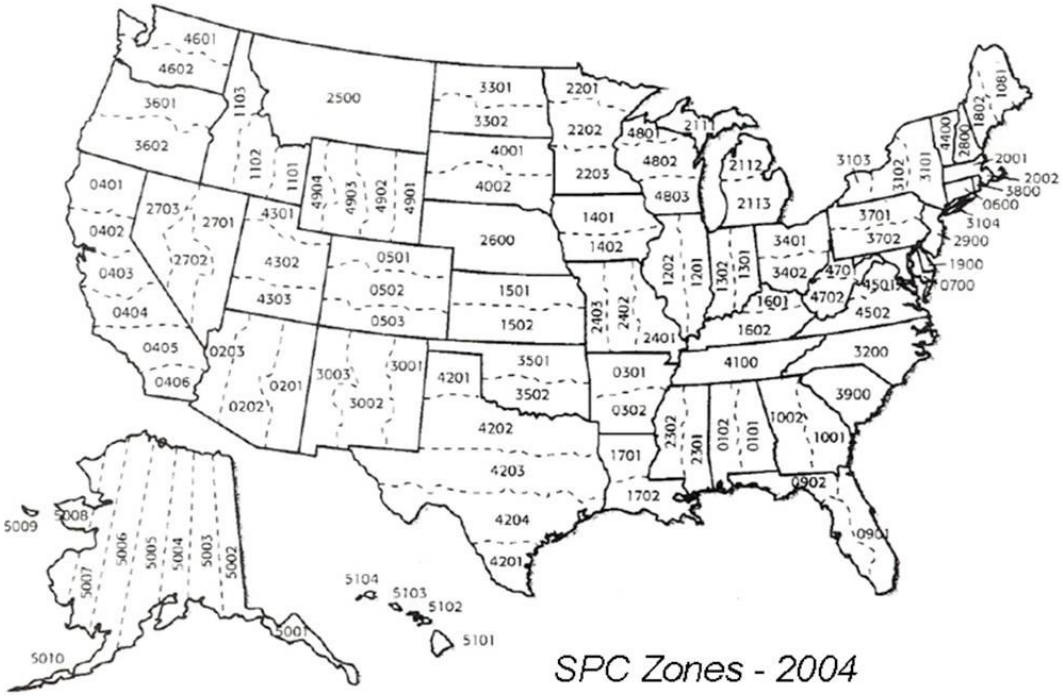
The Universal Transverse Mercator zones are part of a worldwide coordinate system that divides the earth into sections emanating from the poles, accounting for the curvature of the earth.







The State Plane coordinate system identifies zones within each state, but does not account for the curvature of the earth.



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CONFIGURING GPS

The following tables list the output options that should be enabled on common brands of GPS systems. If your GPS system does not appear on this list, please contact your dealer or technician for setup details and assistance. The Hz (update) rate and Baud rate must also be determined. To set these in **Topo**, press the Menu icon, select *Instrument Menu*, *Control the Instrument* and adjust the Hz and Baud rates.

BRAND	MESSAGE TYPE	HZ RATE	BAUD RATE
ASHTECH™	GGA	10	57600
TOPCON™	GGA	10	57600
JD™ ITC	GGA	5	38400
JD™ 3000	GGA	10	57600
NOVATEL™	BESTPRO	10	57600
300/410	BESTPRO	10	57600
TRIMBLE™ (OLDER)	GGK	10 & ASAP	38400
TRIMBLE™ (NEWER)	GGA	10	57600

Each individual RTK-GPS system will have a standard for being in fix, and the type of data and degree of precision it returns.

BRAND	RTK FIXED	RTK FLOAT	NO RTK BASE	PRECISION
GGA (GENERIC/ASHTECH™)	4 OR 3	5 OR 2	1	HDOP
JOHN DEERE™	4	10	57600	HDOP
NOVATEL™ /SOKKIA™ /BEELINE™	50	5	38400	ALT. STD. DEVIATION
TOPCON™ (JAVAD™ JGGA)	4	5	1	HDOP
TRIMBLE™ (GGK)	3	2	1	HDOP

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CONFIGURING GPS

HDOP, VDOP and PDOP are abbreviations for the Horizontal, Vertical and Positional (3D) dilution of precision. The precision of multiple satellites in view of a receiver, combined with their relative positions, determines the level of precision.

When visible GPS satellites are close together in the sky, the geometry is said to be weak and the DOP value is high; when they are far apart, the geometry is strong and the DOP value is low. Thus, a low DOP value represents a better GPS positional precision due to the wider angular separation between the satellites that were used to calculate a GPS unit's position. Other factors that can increase the effective DOP are obstructions, such as nearby mountains or buildings.

DOP VALUE	RATING	DESCRIPTION
< 1	Ideal	This is the highest possible confidence level to be used for applications demanding the highest possible precision at all times.
1 - 2	Excellent	At this confidence level, positional measurements are considered accurate enough to meet all but the most sensitive applications.
2 - 3	Good	This level marks the minimum standard appropriate for making business decisions. Positional measurements could be used for reliable in-route navigation suggestions.
> 3	Poor	This confidence level should be used only to indicate a very rough estimate of a current location.

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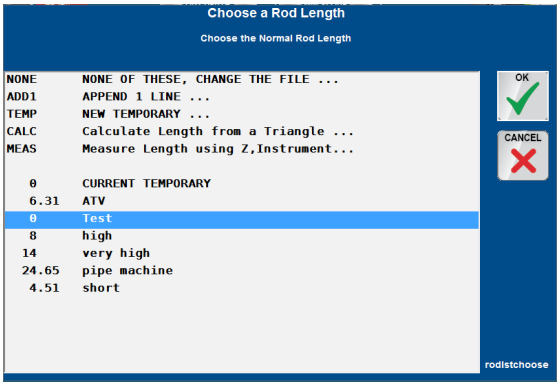
CONTROL POINTS

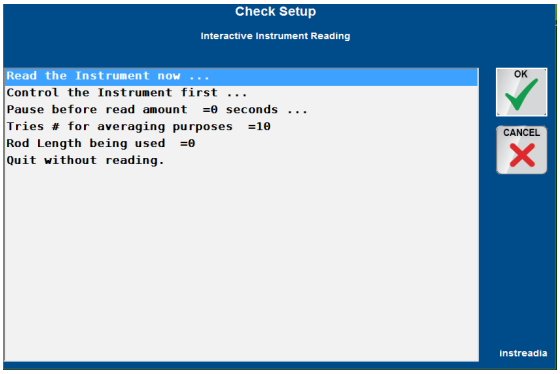
A control point, or benchmark, is a known location in the real world. It has associated coordinate data, and can be accessed at a later date independent of a base station or repeater system. They are required for exact repeatability from topo collection to tiling, and are recommended for day-to-day operations.

Control points can be collected using the *Dashboard* or *Quit Menu*. From the *Quit Menu*, select *Capture a Control Point*.



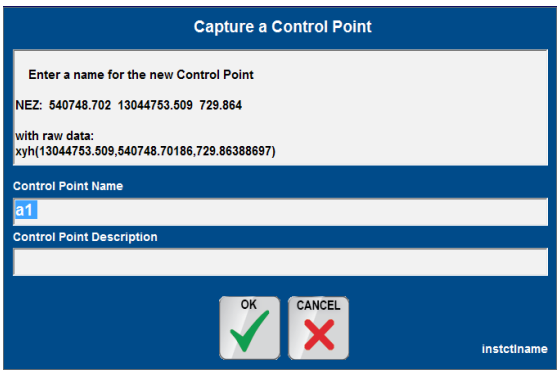
Select a Rod Length

Choose from the typical rod length, or enter a custom measurement.



Read the Instrument

Pause before reading, and set the 'Tries' to 10 or 20 when capturing a point in dense tree cover.



Name the Control Point

After receiving confirmation, name the point and enter a description. The default name is '1' and will increase for each following control point. The point name must be between one and eight letters and/or numbers. The descriptions can be any length.

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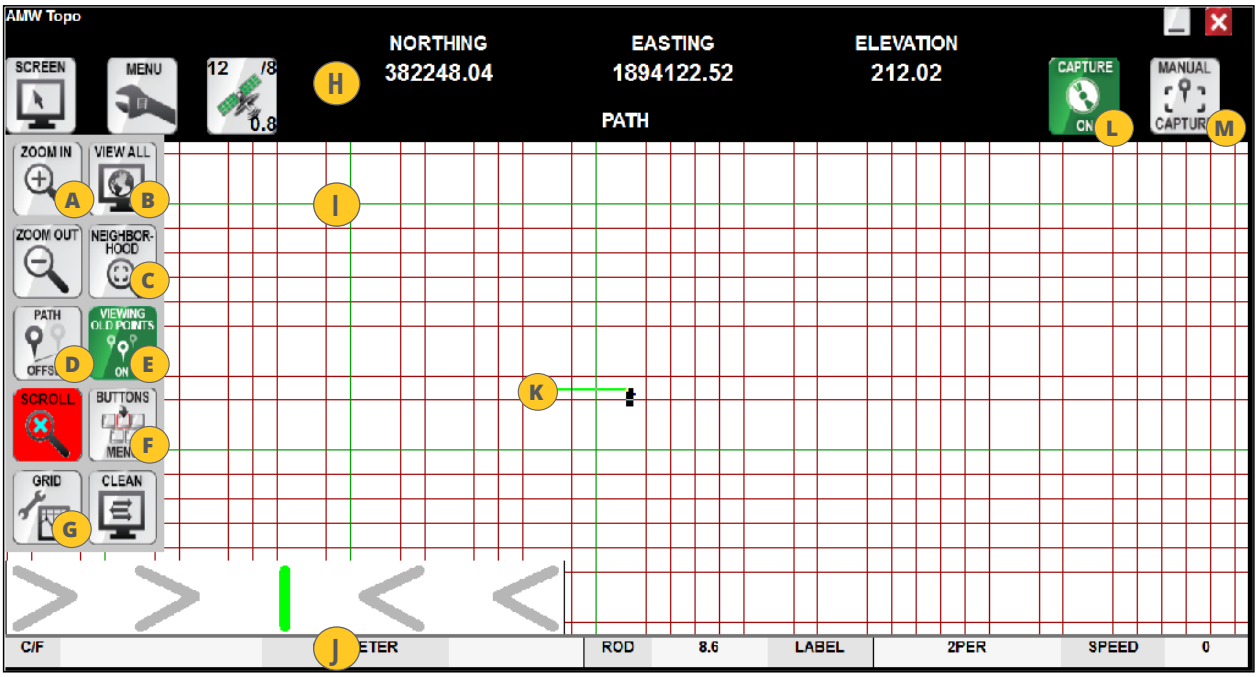
WORKING SCREEN

See Working Screen and Menus manual for more detail.



A. Zoom In/Out

B. View All

C. Neighborhood View

D. Path Offset

E. Turn On/Off Old Points

F. Buttons Menu

G. Grid Menu

H. Menu Bar

I. Plot Screen

J. Info Bar

K. Current Position

L. Capture Mode

M. Manual Point Capture

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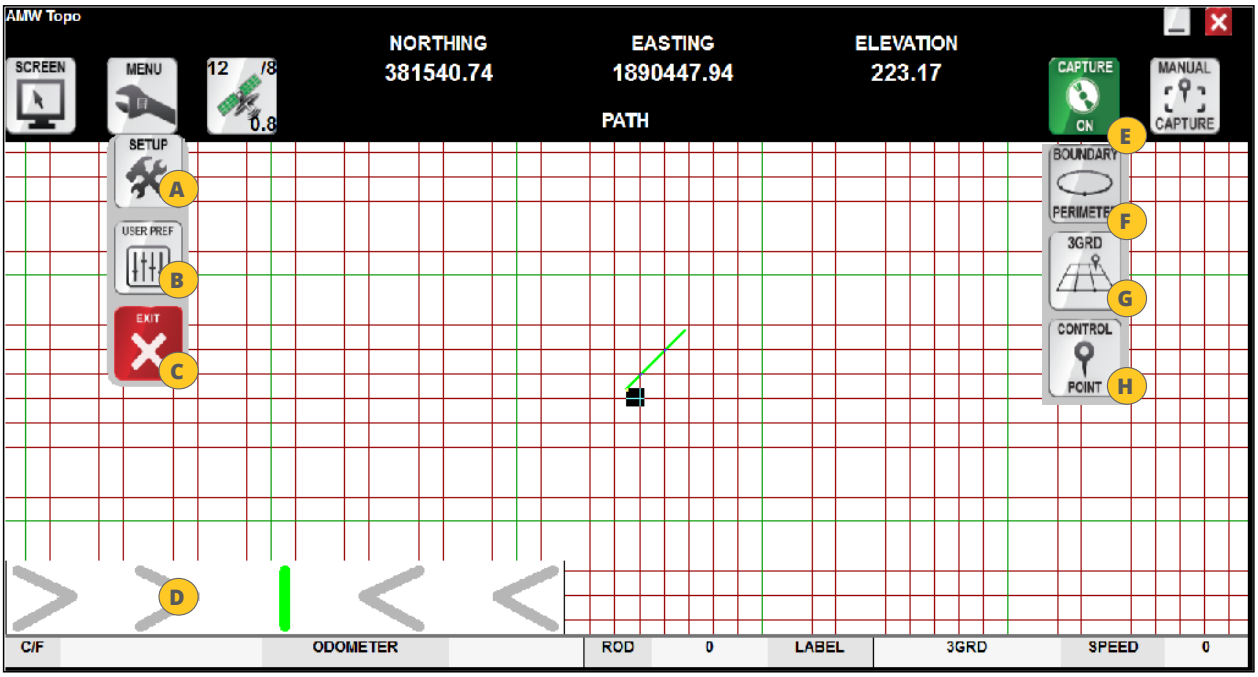
WORKING SCREEN

See Working Screen and Menus manual for more detail.



A. Main Menu

B. Enable Slope Indicator

C. Quit Menu/Return to Dashboard

D. Guidance Light Bar

E. Turn Capture Mode on/off

F. 2PER label mode

G. 3GRD label mode

H. Capture a Control Point

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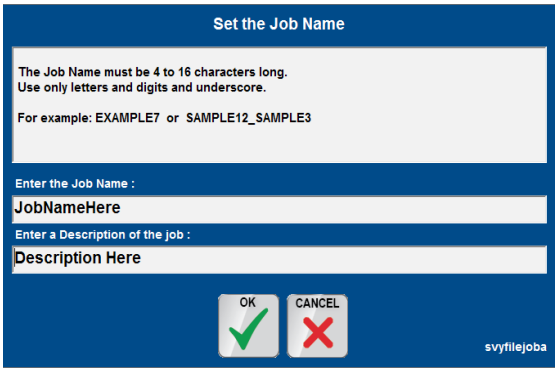
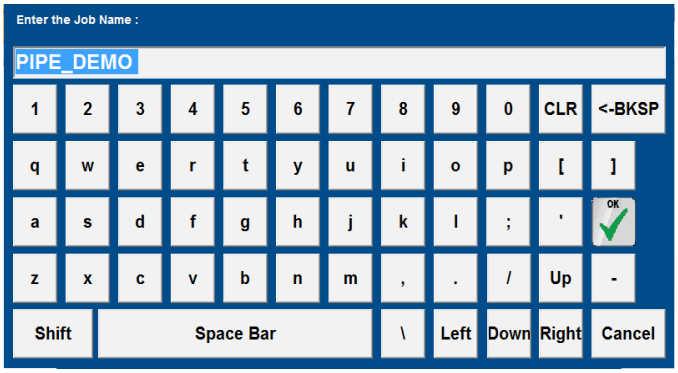
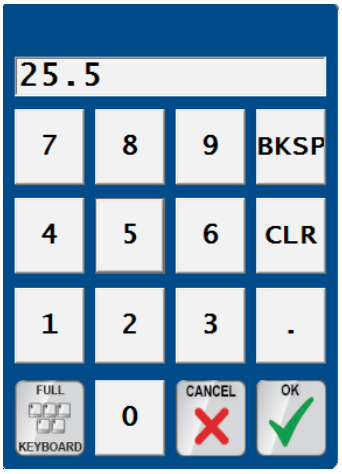
TOUCH KEYBOARD/KEYPAD

You can navigate all aspects of **Topo** using either the touchscreen or keyboard. Touch any text box, such as the job name or job description, to activate the on-screen keyboard.


Set the Job Name
The Job Name must be 4 to 16 characters long.
Use only letters and digits and underscore.
For example: EXAMPLE7 or SAMPLE12_SAMPLE3
Enter the Job Name :
JobNameHere
Enter a Description of the job :
Description Here
OK
CANCEL
svyfilejoba


Enter the Job Name :
PIPE_DEMO
1 2 3 4 5 6 7 8 9 0 CLR <-BKSP
q w e r t y u i o p [ ]
a s d f g h j k l ; ' OK
z x c v b n m , . / Up -
Shift Space Bar \ Left Down Right Cancel

An on-screen numeric keypad will appear where a number entry is needed.



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BUTTONS MENU

The *Buttons Menu* utilizes keyboard hot keys for commonly used program functions. Some functions are only available when **Topo** is installed with an AMW machine control program, such as **Pipe** or **Road.**

HOT KEY	FUNCTION	HOT KEY	FUNCTION
BACKSPACE	Switch pass	P	Pass Menu
PAGE UP	Move blade up	Q	Quit Menu
PAGE DOWN	Move blade down	R	Specify radius to show
ARROW UP	Half of page up	S	Show view from the side
ARROW DOWN	Half of page down	T	Show view from the top
SPACE BAR	Toggle auto capture	U	Main Menu
LEFT MOUSE BUTTON	Click Menu	V	Toggle side and top view
A	Show all points	W	Show view from the west
B	Buttons Menu	X	Grid Menu
C	Find closest control point	Z	Show 3D view looking NNE
D	Find closest data point	0	Toggle machine control on/off
E	Show view from the east	1	Set rod length
F	Cut/fill offset (subgrade)	2	Set point label
G	Toggle stop/go mode	3	Specify a 3D view
I	Zoom in	4	Set the next point number
K	Mark special points	6	Control the instrument
L	Draw line between points	7	Capture a note
M	Manually capture a point	8	Display/Plot Menu
N	Show neighborhood of current position	9	Devices Menu
O	Zoom out	=	Switch rod-length offset

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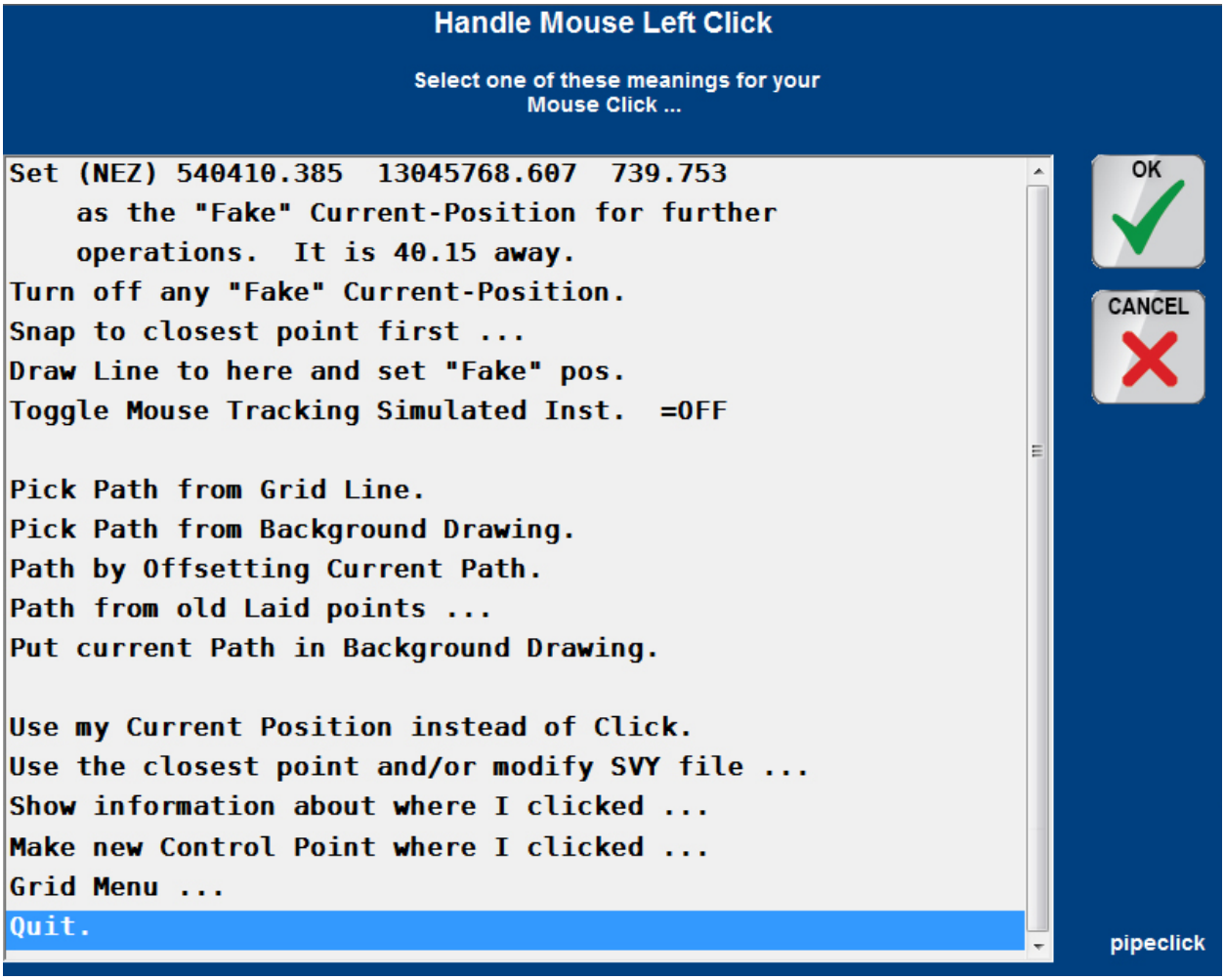
CLICK MENU

Touch the plot window of the Working Screen to activate the *Click Menu*. This menu allows the user to select which function will occur when the mouse buttons are clicked. Each function is designed to assist in surveying.


Handle Mouse Left Click
Select one of these meanings for your Mouse Click ...
Set (NEZ) 540410.385 13045768.607 739.753
as the "Fake" Current-Position for further
operations. It is 40.15 away.
Turn off any "Fake" Current-Position.
Snap to closest point first ...
Draw Line to here and set "Fake" pos.
Toggle Mouse Tracking Simulated Inst. =OFF
Pick Path from Grid Line.
Pick Path from Background Drawing.
Path by Offsetting Current Path.
Path from old Laid points ...
Put current Path in Background Drawing.
Use my Current Position instead of Click.
Use the closest point and/or modify SVY file ...
Show information about where I clicked ...
Make new Control Point where I clicked ...
Grid Menu ...
Quit.
OK
CANCEL
pipeclick

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CLICK MENU

The *Click Menu* contains the following options:

FUNCTION NAME	DESCRIPTION
SET NEZ AS 'FAKE POSITION'	Sets the currently displayed NEZ as a 'fake' position. This position will be used for the zoom, grid and other functions instead of your actual position.
TURN OFF ANY 'FAKE' CURRENT POSITIONS	Turns off any 'fake' positions. After using the scroll icon to move around the screen, you must turn off any 'fake' positions to re-center the screen on the actual current position.
SNAP TO CLOSEST POINT	Snaps to the closest captured point, as opposed to the clicked point.
DRAW LINE TO HERE	Draws a line between the current position and the point you snapped to or clicked.
TOGGLE MOUSE TRACKING	Useful for GPS simulators.
PICK PATH FROM GRID	Chooses the closest grid line as the path for guidance.
PICK PATH FROM BACKGROUND	Chooses the closest background line for guidance.
PATH BY OFFSETTING CURRENT PATH	Offsets your current path by an entered amount and sets it as the path for guidance.
PATH FROM OLD LAID POINTS	Selects the current path from the closest previously laid tile line. This option is often used and followed by offsetting the current path, to easily allow tile to be installed parallel to a previously laid tile line.
PUT CURRENT PATH IN BACKGROUND DRAWING	Places the current path in the background drawing. This function will create a background drawing if one has not yet been loaded.
USE MY CURRENT POSITION	Sets the current NEZ as your current position. The current NEZ is displayed at the top of the click menu.
USE THE CLOSEST POINT AND/OR MODIFY .SVY FILE	Uses the closest point to change a pass label on an already laid path.
SHOW INFORMATION ABOUT WHERE I CLICKED	Shows information about a clicked point, including its distance from the current position, the slope distance and the NEZ (if a previously captured topo is loaded, or it is a known point.) Also shows the angle, which can be useful for rotating a grid to a known point.
MAKE NEW CONTROL POINT WHERE I CLICKED	Runs the control point collection steps for your current position.
GRID MENU	Opens the Grid Menu.

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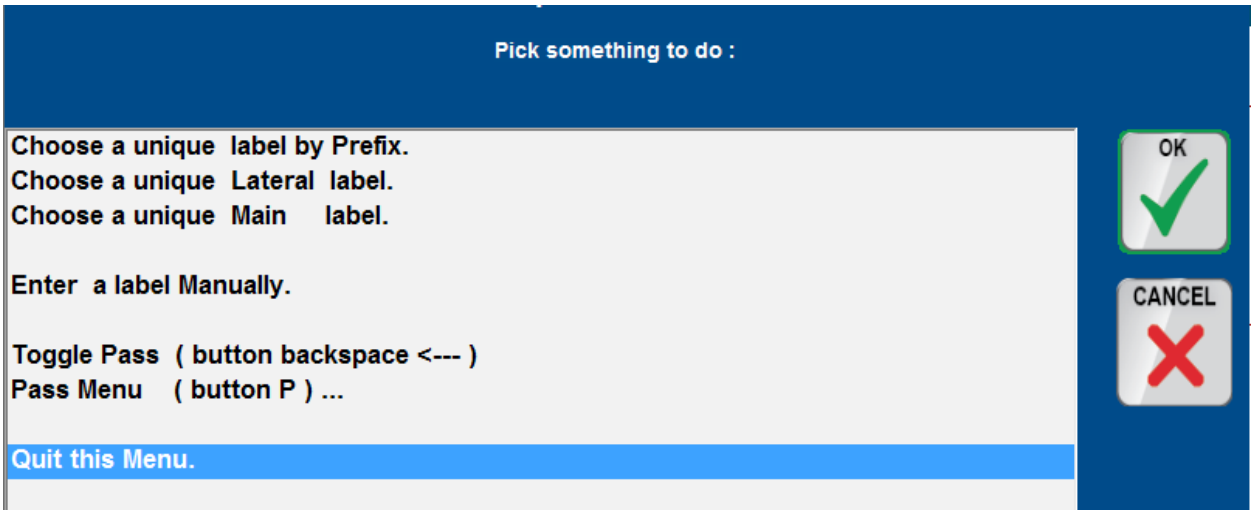
PASS LABELS

Data labels in **Topo** define the type of data being collected. To select a pass label from the *Label Menu*, press *Label* in the info bar of the Working Screen.


Pick something to do :
Choose a unique label by Prefix.
Choose a unique Lateral label.
Choose a unique Main label.
Enter a label Manually.
Toggle Pass (button backspace <---)
Pass Menu (button P) ...
Quit this Menu.
OK
CANCEL

From the *Label Menu*, choose the *Unique Label by Prefix* option to open the *Choose a Point-Label Menu*.

The *Choose a Point-Label Menu* contains the following options:

FUNCTION NAME	DESCRIPTION
ADD1	Adds a user defined label to the point label list. For proper reporting, labels must begin with the number 2 and contain no spaces. For instance, a label for a 15 inch tile functioning as a main would read '2M150.'
TEMP	Creates a new temporary label, but does not add it to the permanent list. For proper reporting, labels must begin with the digit 2 and contain no spaces.
INCR	Increases the current pass label by one.
1STAKE	The current temporary. '1STAKE' is used as a label for putting a stake or other note into the job.
2PER	Defines the perimeter of the job or other lines.
3GRD	Defines random ground elevation points.

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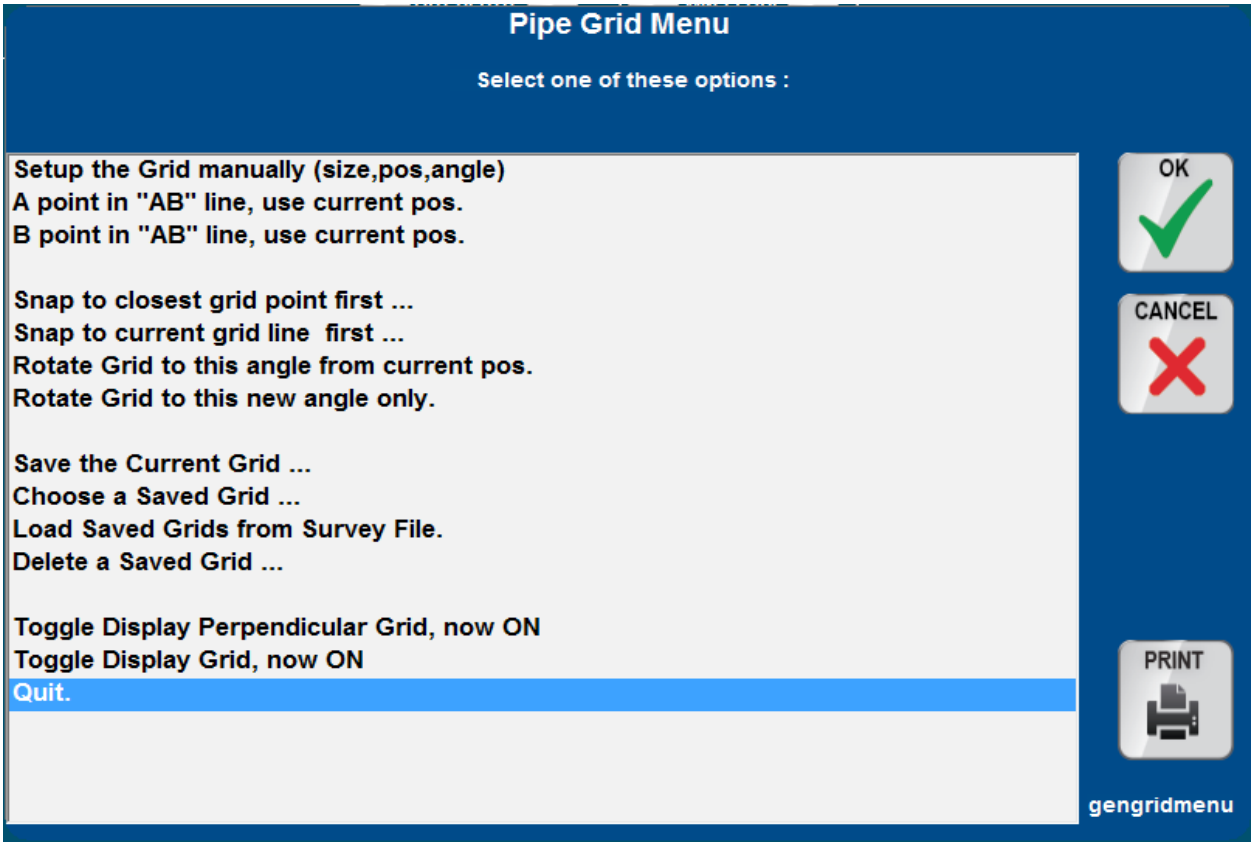
GRIDS

Access the *Grid Menu* by pressing the *Screen* icon and selecting *Grid*. To adjust the grid, touch or click on the grid line you want to use. To automatically highlight the nearest grid line, see the *Toggle Paths Along Grid Lines* options within the *Parameters Menu*.


Pipe Grid Menu
Select one of these options :
Setup the Grid manually (size,pos,angle)
A point in "AB" line, use current pos.
B point in "AB" line, use current pos.
Snap to closest grid point first ...
Snap to current grid line first ...
Rotate Grid to this angle from current pos.
Rotate Grid to this new angle only.
Save the Current Grid ...
Choose a Saved Grid ...
Load Saved Grids from Survey File.
Delete a Saved Grid ...
Toggle Display Perpendicular Grid, now ON
Toggle Display Grid, now ON
Quit.
OK
CANCEL
PRINT
gengridmenu

Selecting *Set up the Grid Manually* offers these options:

Grid Size

Adjusts the density of the displayed grid lines. Course detail will be displayed as green grid lines; fine detail will be red. When, for example, tiling every 35 feet, you may choose to set the course detail at 70 feet and the fine detail at 35. This will appear as alternating green and red grid lines occurring every 35 feet.

Grid Offset

This option offsets the grid lines a designated amount north (N) east (E) and above or below (Z.) To offset the grid ten feet north and west of its current location, add ten feet to N and subtract ten feet from E.

Grid Angle

This option rotates the grid lines by a designated number of degrees.

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GRIDS

The *Grid Menu* contains the following additional options:

FUNCTION NAME	DESCRIPTION
A POINT IN AB LINE/ B POINT IN AB LINE	Snaps the grid to an AB point. To snap along your first lateral while surveying, set the A point as the high point, drive the line and set the B point.
SNAP TO CLOSEST GRID POINT/SNAP TO CLOSEST GRID LINE	Snaps to the closest grid point or line. This is useful in setting your path or rotating the grid to a new position relative to the old grid.
ROTATE GRID TO THIS ANGLE FROM CURRENT POSITION	Snaps the grid from your current position to where you clicked.
ROTATE GRID TO THIS NEW ANGLE ONLY	Keeps grid northing and easting as set in the Set Up Grid Manually options, changing only the angle of the grid from the point you clicked.
SAVE THE CURRENT GRID	Saves the current grid.
CHOOSE A SAVED GRID	Recalls a saved grid.
LOAD SAVED GRID FROM SURVEY FILE	Pick from grids saved across different jobs. Locate the grid, then select choose a saved grid.
DELETE A SAVED GRID	Deletes a saved grid.
TOGGLE DISPLAY PERPENDICULAR GRID	Shows both the horizontal and vertical lines when toggled on; shows only one grid line when toggled off.
TOGGLE DISPLAY GRID	Toggles the entire grid display on and off.

Touching or clicking a grid line will open the *Click Menu*. To automatically highlight the nearest grid line, see the *Toggle Paths along Grid Lines* option in the *Parameters Menu*.

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PASS TYPES

Many machine control programs, such as the AMW **WaterCourse**, **Pipe**, **Road** or **Ditch** series, require highly accurate data. **Topo** incorporates three types of passes used to collect reliable data for these applications.

Boundary Perimeter

A pass used to collect boundary or perimeter points along the edge of a job. Data points will have a pass label of 2PER.

Random Ground

A pass used to collect random topography points within an area. Data will have a pass label of 3GRD.

Reference

A pass used to collect reference or control points for the future.

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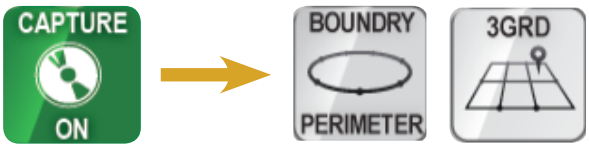
TOPO A FIELD

When you have determined whether you need boundary data or random points within an area, access the *Working Screen* to begin collection.

1. Press and hold the *Capture* icon until the pass type menu appears. Touch the appropriate icon for your job.



2. Turn the Capture mode on and proceed with data collection.

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REFERENCE POINTS

To collect reference points for the future, begin by accessing the *Working Screen*.

1. Press and hold the *Capture* icon until the pass type menu appears. Select the *Reference* icon.

2. Enter the appropriate Rod Length.

3. Read the instrument, with the *Tries for Averaging* set to 10. When in dense tree cover, set to 20.

4. Name the reference point and give a description. The default name will be '1.' This number will increase with each point captured.

5. Reset the Rod Length as required.

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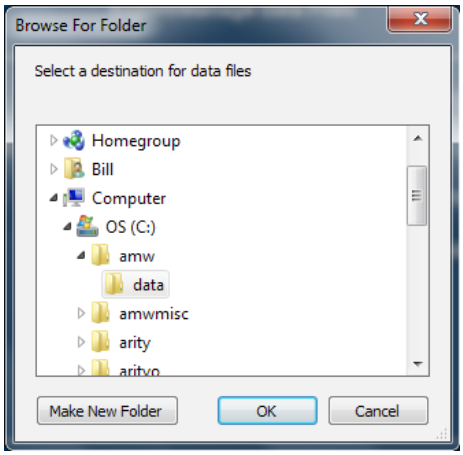
EXPORT DATA

Topo can export most common types of data using the *Dashboard*. From the Working Screen, close the program be selecting the *Menu - Quit this Application* option or clicking . Once at the *Dashboard*, select *Job Management*, then *Export/ Manage Data*. The filetypes available for export will be checked; uncheck any that are unnecessary. Choose a save location for the data, and press *Ok*.



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QUIT THE APPLICATION

To exit the **Topo** application, click the in the upper right corner, select *Quit this Application* from the *Main Menu*, or press the 'Q' key. The *Quit Menu* contains functions that can be performed before fully quitting the program.

Standard Quit Actions

This option creates a backup, NEZ, and distance report, then quits the program.

Backup Job

This option saves a backup of the job to an external destination, such as a USB drive or other storage device.

Zip up Whole Job

This option saves a .zip file to an external destination, such as a USB drive or other storage device.

Copy JOBNAME

This option copies any file associated with the current job name to an external destination, such as a USB drive or other storage device.

Make an NEZ file

This option creates a Northing-Easting-Elevation file out of the survey file.

Make an NEZ file from SVY and RIP Passes

This option creates a Northing-Easting-Elevation file from the SVY and RIP Pass data.

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TROUBLESHOOT TOPO

Set Up

SYMPTOM	SOLUTION
The screen flashes red after setup is finished	This is typically related to an issue with the GPS signal. See the 'GPS Errors' troubleshooting section on page 42.
A setup step was missed/ an error was made	Press the Menu icon on the Working Screen, then start the setup process again.

Control Points

SYMPTOM	SOLUTION
Difficulty choosing control point locations	Choose locations that aren't likely to change, are easily relocated and easily accessed. Consider landmarks similar to a fencepost or a culvert.
Using control points for multi-day jobs	Capture a control point at the end of each work day, after ensuring that the plow is raised to avoid settling. The following day, load the control point before moving.
Double control points through the RTK-GPS memory	AMW highly recommends using both the Topo and RTK-GPS control points. Base station memory can become lost or damaged, and tripods are often stolen when they remain in fields.

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TROUBLESHOOT TOPO

GPS errors

SYMPTOM	SOLUTION
COM PORT IS ALREADY IN USE	The GPS unit is connected to a communications port that is being used by another program or not communicating properly. First, verify that the GPS is connected to the correct communications port. If correct, disconnect the GPS unit from the port, shut down the computer, restart the computer, restart Topo and finally reconnect the GPS.
NO GPS DATA	The GPS unit is not sending a signal or the computer is unable to receive the signal. Verify that the GPS is powered on, then verify the cables are connected to the communications port properly.
BAD DATA	The GPS unit is sending bad or incorrect data. First, verify that the GPS is connected to the proper communications port and configured correctly. Then verify that Topo is configured for the correct instrument, incoming baud rate and update rate.
BAD POSITION TYPE X (#)	The GPS unit is not communicating with the base station. Verify that the base station is powered on and within manufacturer guidelines for distance. Verify the rover is configured correctly to read the base station.
GPS IS IN AND OUT OF FIX	Check the line-of-sight with the base for obstructions, and verify satellite visibility. Ensure that the GPS rover antenna is not damaged or loose.

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